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EXPERIMENTS WITH PYRETHRUM-OIL SPRAYS FOR CONTROL OF THE TOBACCO MOTH AND THE CIGARETTE BEETLE [1]

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Experiments on the control of the tobacco moth (*Ephestia elutella* (Hbn.)) and the cigarette beetle (*Lasioderma serricorne* (F.)) in stored tobacco were conducted in South Carolina, North Carolina, and Virginia, from 1941 to 1948, inclusive. The major objective was to determine the value of weekly applications of pyrethrum-oil sprays in preventing the development of damaging infestations of these insects in commercial warehouses of stored flue-cured tobacco. Another objective was to compare this method of control with more established methods.

Experimental Procedure

Both open and closed warehouses were included in these experiments. The tobacco moth is the more destructive pest in open houses, and the cigarette beetle in closed houses.

A spray containing 0.2 percent of pyrethrins was used against the tobacco moth, and one containing 1 percent of pyrethrins against the cigarette beetle. Sprays were applied by means of a mobile power sprayer designed for use in tobacco warehouses (Tenhet 2). The dosage was 100 ml. (about 3 fl. oz.) per 1,000 cubic feet of air space. Care was taken to distribute the spray throughout the space in each warehouse.

The sprays were prepared by diluting pyrethrum extract concentrates with a light volatile oil. The manufacturer's specifications for this oil were as follows: Maximum specific gravity at 60° F., 0.797; flash point 175° F.; colorless; and no kerosene odor.

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The time of the first application and effectiveness of the treatments was determined by the weekly catches of adult insects in suction light traps operated in each warehouse. The first application was usually made as soon as the weekly trap catch showed 10 or more insects. Applications were repeated at 7-day intervals, or occasionally every 6 or 8 days. After the first treatment trap catches were kept below 50 insects if possible, as this catch is considered potentially dangerous All the spraying was done under the general supervision of the author.

Some of the warehouses were left untreated as checks Others were dusted weekly with pyrethrum or fumigated from one to three times during the season with hydrogen cyanide, as described by Reed and Vinzant (1).

Control of Tobacco Moths

Experiment in screened, open-type warehouses.--In an experiment at Richmond, Va., in 1945, trap catches were recorded in eight untreated warehouses, eight that were sprayed, and eight that were dusted weekly on the same day to control the tobacco moth. The spray contained 0.2 percent of pyrethrins and the dust 0.8 percent. All the warehouses were approximately the same size, each about 230,000 cubic feet. They were in the same group and were believed to be comparable in every way, except that there was a slightly lower initial infestation in the eight untreated houses.

The results are shown in table 1. In only 4 weeks of the summer did the catch in the sprayed warehouses exceed 50 moths. In the dusted warehouses the catch exceeded 50 moths in 15 of the 20 weeks. In the untreated warehouses the weekly catch was well above 50 moths each week.

The spraying was not only more effective, but also cheaper and less objectionable than the dusting.

Experiment in unscreened or partly screened, open-type warehouses.--In another experiment in 1946, 16 unscreened or partly screened warehouses in the same group were sprayed weekly. Each of these warehouses had a capacity of about 230,000 cubic feet A comparison of the infestation in these warehouses with that in 16 similar untreated houses is shown in table 2. In this experiment the initial infestation of all warehouses was somewhat higher than the infestations shown in table 1 The average weekly catch in the sprayed storages was 245 tobacco moths, as compared with 1,312 moths in the untreated storages. Although the infestation was substantially reduced, it was not brought completely under control

Experiment in screened, closed-type warehouses.--In 1948, 81 closed warehouses were sprayed weekly with pyrethrum in oil, and 40 were fumigated with hydrogen cyanide two or more times. These warehouses ranged in size from approximately 80,000 to 631,000 cubic feet, averaging about 300,000 cubic feet. The number of warehouses from which records were received varied from week to week because of factors such as geographical location and sale of tobacco, but averaged 73 sprayed and 33 fumigated warehouses.

The object of spraying was to kill the adult insects before they could lay eggs. Spraying was begun therefore as early in the spring as any appreciable number of adults appeared. Fumigation was scheduled to follow immediately after the peak of emergence (of adults) of each brood, except that a warehouse containing only tobacco of the previous year's crop was scheduled for fumigation as early in the spring as a weekly trap catch of 50 moths was obtained. The average weekly trap catches of tobacco moths are shown in table 3. In only 3 of 28 weeks was an appreciable trap catch of moths taken in the sprayed warehouses, and these 3 weeks were at the beginning of the season. The spray gave much better control of the tobacco moth than the fumigations.

These 81 warehouses contained over 120 million pounds of flue-cured tobacco. No effect of the spray on the taste, aroma, texture, or aging of the tobacco was detected.

Control of Cigarette Beetles in Screened, Closed-Type Warehouses

Late in the summer of 1945 a heavy infestation of cigarette beetles developed in two warehouses of Turkish tobacco at Richmond, Va. One warehouse was sprayed with pyrethrum in oil weekly from July 26 until September 27, a period of 10 weeks. The spray contained 0.5 percent of pyrethrins, except that on August 17 and 24 twice that strength was used. Results of this experiment are shown in table 4. The infestation of cigarette beetles was brought under control.

In 1948 seven warehouses at Norfolk, Va., were sprayed weekly from April 6 to July 17 with oil containing 0.2 percent of pyrethrins to control the tobacco moth. A light infestation of the cigarette beetle developed in July, and the spray was changed on July 24 to one containing 1 percent of pyrethrins. Spraying was stopped on October 21.

Table 5 shows that the infestation was held to a very low level. Eight warehouses at Wilmington, N. C., also showed a light infestation of the cigarette beetle in June and July. These warehouses were fumigated twice with hydrogen cyanide (16 oz. per 1,000 cu. ft.)--on April 28 and August 23. It can readily be seen that the spray was more effective than the two fumigations in holding down the infestation of cigarette beetles.

In 1948, 31 warehouses at Charleston, S. C., and 5 at Wilmington, N. C., were heavily infested with the cigarette beetle. The warehouses at Charleston were sprayed weekly with pyrethrum in oil, those at Wilmington were fumigated twice, and 4 of the storages were fumigated three times. The dosage of hydrogen cyanide was 16 to 20 ounces per 1,000 cubic feet. The pyrethrum-oil spray contained 0.2 percent of pyrethrins until May 4, when it was changed to a 1-percent spray. Table 6 shows that effective control was not obtained by either spray or fumigation, although the fumigation was the more effective. In both groups of warehouses a heavy infestation of the cigarette beetle had developed in the late summer of 1947. This infestation had penetrated the tobacco so deeply that it was very difficult to control.

Relative Cost of Spraying and Fumigation

The cost of using pyrethrum-oil spray varied with the strength of spray used, the cost of labor, and the number of warehouses treated. Of 78 warehouses sprayed under widely varying conditions in 1948, the cost per season ranged from $157 to $414 per warehouse and the average was $381.

Under comparable conditions of labor, the cost figures were obtained for sealing and fumigating 44 warehouses in 1948. Again the cost varied widely, but the estimated average cost per warehouse per fumigation was $507.

These figures are given in detail in table 7. It can be seen that the cost of spraying was substantially less than for fumigation with hydrogen cyanide. A warehouse was sprayed for a season to control the tobacco moth for approximately half the cost of a single fumigation. It was sprayed for the season to control the cigarette beetle for less than the cost of one fumigation.

Summary

Experiments with pyrethrum-oil sprays for the control of the tobacco moth (*Ephestia elutella* (Hbn.)) and the cigarette beetle (*Lasioderma serricorne* (F.)) in stored tobacco were conducted in Virginia, North Carolina, and South Carolina in 1941-1948. The experiments with tobacco moths were in both open and closed warehouses; those with cigarette beetles were in closed houses only. Most of the houses were screened.

All sprays were applied weekly at 100 ml. (3 fl. oz.) per 1,000 cubic feet of air space. The tobacco moth was controlled with a spray containing 0.2 percent of pyrethrins in a light volatile oil. Spraying was more effective, cheaper, and less objectionable than dusting with pyrethrum powder. It was also more effective than two atmospheric fumigations during the season with hydrogen cyanide, and was substantially cheaper.

Development of cigarette beetle populations was retarded by a spray containing 1 percent of pyrethrins in a light volatile oil. A light infestation of this insect was controlled as effectively with the sprays as with two fumigations with hydrogen cyanide, and much more cheaply. Where a heavy infestation had already developed, however, the spray was less effective than three fumigations with hydrogen cyanide, and gave inadequate control in some instances.

Although beneficial, the spray program did not keep the infestation so low in unscreened warehouses as in screened ones.

In 1948 pyrethrum-oil spray was applied in 81 screened, closed-type warehouses containing over 120 million pounds of flue-cured tobacco without any observed effect upon the taste, aroma, texture, or aging of the tobacco.

Literature Cited

(1) Reed, W. D., and J. P. Vinzant.
1942. Control of insects attacking stored tobacco and tobacco products. U. S. Dept. Agr. Cir. 635, 40 pp., illus.

(2) Tenhet, Joseph N.
1946. A power sprayer for applying concentrated insecticides. U. S. Bur. Ent. and Plant Quar. ET-231, 4 pp., illus. [Processed.]

(3) ________________
1947. Pyrethrum-oil sprays in open-type tobacco warehouses. U. S. Bur. Ent. and Plant Quar. E-717, 5 pp. [Processed.]

Table 1 --Average number of tobacco moths taken in suction light traps in screened, open-type warehouses, 8 sprayed weekly with pyrethrum in oil, 8 dusted weekly with pyrethrum, and 8 untreated. Richmond, Va., 1945

Trapping period, week ending—		Untreated	Dusted	Sprayed
May	31	995 [1]	1,524 [1]	1,252 [1]
June	7	1,184	317	122
	14	989	169	14
	21	371	85	11
	28	305	61	7
July	5	96	21	9
	12	193	89	33
	19	202	44	7
	26	756	57	7
Aug.	2	2,556	178	27
	9	2,811	165	84
	16	3,025	161	104
	23	1,644	42	28
	30	2,287	173	41
Sept.	6	2,681	456	109
	13	1,712	71	19
	20	1,200	148	28
	27	512	49	7
Oct.	4	581	12	10
	11	461	87	37
	18	256	112	48
Weekly average		1,191	125	38

[1] Catch for the week prior to first application on May 31; figure not included in the average.

Table 2.--Average number of tobacco moths taken in suction light traps in unscreened and partly screened, open-type warehouses, 16 sprayed weekly with pyrethrum in oil and 16 untreated. Richmond, Va., 1946

Trapping period, week ending—	Unsprayed	Sprayed
June 5	2,019 [1]	2,444 [1]
12	1,565	519
19	1,183	131
26	630	82
July 3	260	35
10	205	150
17	335	173
24	912	259
31	2,095	632
Aug. 7	3,127	446
14	2,978	544
21	3,862	788
28	2,139	268
Sept. 4	1,248	367
11	660	67
18	695	71
25	1,088	104
Oct. 2	645	43
9	248	10
Weekly average June 19 to October 9	1,312	245

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[1] Catch for weeks prior to first application on June 16 not included in the average.

Table 3.--Average number of tobacco moths taken in suction light traps in screened, closed-type warehouses, 81 sprayed weekly with pyrethrum in oil and 40 fumigated at least twice with hydrogen cyanide. Virginia, North Carolina, and South Carolina, 1948

Trapping period, week ending—	Fumigated		Sprayed	
	Number of warehouses reporting	Tobacco moths	Number of warehouses reporting	Tobacco moths
Apr. 2	17	0	33	0
9	17	2	33	0
16	17	297	33	21
23	32	451	59	321
30	21	14	60	139
May 7	43	151	81	66
14	40	934	81	28
21	40	922	81	21
28	23	70	80	32
June 4	39	138	80	16
11	39	125	79	12
18	39	193	79	11
25	39	285	78	4
July 2	39	137	78	6
9	39	63	78	4
16	39	130	78	9
24	39	234	78	7
30	39	447	78	16
Aug. 6	36	555	78	11
13	28	585	78	9
20	26	890	78	4
27	22	306	78	5
Sept. 4	29	225	78	6
11	36	362	78	10
18	34	862	78	7
25	28	1,112	75	4
Oct. 1	33	1,837	75	7
8	39	659	75	8
15	39	725	68	6
Weekly average	33	454	73	28

Table 4.--Average number of cigarette beetles taken in suction light traps in 2 screened, closed-type warehouses of Turkish tobacco, 1 sprayed weekly with pyrethrum in oil from July 25 to September 26 and the other untreated. Richmond, Va., 1945

Trapping period, week ending—	Untreated	Sprayed
July 19	3,600	5,600
26	6,000	10,000
Aug. 2	6,600	10,700
9	7,800	5,000
16	14,200	3,000
23	21,000	340
30	106,000	150
Sept. 6	116,670	70
13	30,000	300
20	16,683	24
27	23,300	24
Oct. 4	15,000	35
11	2,000	2
18	750	0
25	10,000	16

Table 5.--Average number of cigarette beetles taken in section light traps in screened, open-type warehouses, 7 sprayed weekly with pyrethrum in oil and 8 fumigated twice with hydrogen cyanide Norfolk, Va., and Wilmington, N. C., 1948

Fumigated		Sprayed	
Trapping period, week ending -	Cigarette beetles	Trapping period week ending -	Cigarette beetles
Apr. 5	1	Apr. 8	0
14	3	15	0
21	2	22	0
28	-	29	0
May 3	0	May 5	0
10	0	13	0
18	1	19	0
24	0	27	0
31	4	June 3	0
June 7	10	9	0
15	3	16	4
21	14	23	0
29	6	30	0
July 6	10	July 7	1
13	22	14	7
20	44	21	49
27	115	28	55
Aug. 3	169	Aug. 4	45
10	232	11	13
17	809	18	5
24	-	25	10
31	0	Sept. 1	82
Sept. 7	23	8	67
14	70	15	39
21	179	22	31
Oct. 2	564	Oct. 1	14
8	171	8	6
15	89	15	1
22	35	21	0
28	5	29	0
Nov. 4	20	Nov. 4	0
11	8	11	0
17	4	18	0
24	0	25	0

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Table 6.--Average number of cigarette beetles taken in suction light traps in screened, closed-type warehouses, 31 sprayed weekly with pyrethrum in oil and 5 fumigated with hydrogen cyanide. Charleston, S. C., and Wilmington, N. C., 1948

Trapping period, week ending—		Fumigated[1]	Sprayed
Mar.	9	9	0
Apr.	6	5	0
	13	8	0
	20	28	0
	27	Fumigated	1
May	4	2	47
	11	33	358
	19	167	381
	26	738	146
June	1	2,513	102
	8	4,990	32
	15	3,928	37
	22	1,206	625
	29	Fumigated	4,523
July	6[2]	113	11,431
	13	336	2,094
	20	1,538	1,548
	28	3,825	3,970
Aug.	4[2]	2,064	1,505
	11	1,430	4,296
	18	7,445	5,666
	25[2]	Fumigated	13,801
Sept.	1	0	24,822
	8	335	4,664
	15	117	9,160
	22	710	6,728
	30	3,240	4,329
Oct.	7	1,315	4,345
	14	1,044	2,684
	21	240	1,227

[1] One warehouse fumigated only twice, on April 28 and August 24; others fumigated three times.

[2] Sprayed twice this week.

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Table 7.--Costs of spraying tobacco warehouses with pyrethrum oil and of fumigating warehouses with hydrogen cyanide, 1948

Location	Number of warehouses treated	Cost per warehouse			
		Insecticide or fumigant 1/	Application	Other costs 2/	Total
		Spraying for Season			
Norfolk, Va.	26	$ 161	$ 232	-	$ 393
Charleston, S. C.	31	356	48	$ 10	414
Camp Butner, N. C.	19	270	53	10	333
Wilson, N. C.	2	125	25	7	157
		One Fumigation			
Wilmington, N. C.	8	-	-	100	-
Norfolk, Va.	10	405	-	79	484
	9	446	-	79	525
Charleston, S. C	5	757	-	47	804
	9	503	-	47	550
Newport News, Va.	11	327	-	15	342

1/ Cost of fumigant includes cost of application.

2/ Includes cost of sealing for fumigation.